life? What percentage of patients requires repetitive imaging scans and further irradiation, and at what risk? What is the morbidity and mortality attendant to the biopsies and surgery for lesions that ultimately turn out to be benign?

I believe we are at a crossroads where additional input from epidemiologists, oncologists, radiologists, cardiologists, and others is required to delineate further how far to widen or restrict the MDCT "field of view." Because large randomized prospective studies are unlikely in this regard, perhaps mathematical models of outcomes and costs could be formulated.

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Reply

Dr. Fleet raises important questions, and there is legitimate concern that computed tomography (CT) scan "incidentalomas" can result in unnecessary or inappropriate testing at the expense of the insurance system and/or risk to the patient (1,2).

The main issue regarding cardiac CT is, of course, coincident imaging of the adjacent lungs. Although lung cancer is the number one cause of cancer-related deaths in all men and women in America, the finding of variable size "lung nodules" is much more common than true malignant disease. Dr. Fleet asks: "When found, are the newly discovered malignancies curable or amenable to treatment that prolongs life or improves quality of life?" We may never have a complete answer to this inquiry. However, the overall survival rates for lung cancer are dismal, and the most recent report from the ELCAP (Early Lung Cancer Action Program) study (3) may provide a partial response. Henschke and colleagues (3) did screening lung scans in adults over 40 years old with either a history of cigarette smoking, an occupational exposure risk, or significant exposure to second-hand smoke, and they found that stage I lung cancers discovered (and treated) resulted in a projected 80% 10-year survival. These subjects are, coincidentally, at greatest risk for atherosclerotic heart disease. Importantly, however, lung cancer was found in only 484 (1.5%) of 31,567 screened individuals.

Dr. Fleet asks, "What is the morbidity and mortality attendant to the biopsies and surgery for lesions that ultimately turn out to be benign?" This is a rhetorical question as we do not have this information; however, in *most* instances biopsies are unnecessary, and follow-up low-dose CT scanning may be the only suggested consequence. In medicine we tend to "pass the buck" when it comes to test results that are unanticipated, and the best way to reduce unnecessary follow-up testing or procedures is physician education. There are guidelines published by the ELCAP investigators (4), which prescribe follow-up on the basis of lung nodule dimensions. More recently the Fleischner Society (5) described the workup of small pulmonary nodules incorporating smoking history as part of the clinical algorithm.

I agree that we are at a crossroad to define the clinical impact of diagnostic CT angiography and "extravascular" pathology, regardless of whether it involves the heart/chest, neck, abdomen, or periphery. The issue clearly extends beyond traditional single-specialty medicine. Recently, a published commentary (6) addressed training in advanced cardiovascular imaging, stating that "specific interpretation of the extra-cardiac fields should be performed. . . . Regarding the cardiovascular medicine specialist performing a cardiac CT, the American College of Cardiology recognizes and endorses education and training of such individuals in the recognition of incidental scan findings in support of quality imaging care of patients with cardiovascular disease. . . . To this end, it is felt that Level 2 and Level 3 training should include review of all cardiac CT for noncardiac findings."

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Reply

We thank Dr. Fleet for his interest in our study (1) and appreciate his comments. We agree with Dr. Fleet as to the necessity of further evidence to establish the clinical significance of noncardiac analysis in cardiac multidetector computed tomography (MDCT). Our study lacks long-term clinical follow-up to discuss clinical outcomes. In addition, we did not discuss cost because the actual cost of additional follow-up, including surgery, biopsy, and imaging, varies among countries and institutions. As clinical results and costs could be different depending on how referring physicians

respond to the reports, a mathematical analysis regarding outcomes and cost might be suitable.

At this time, in our institution, we perform both cardiac and noncardiac analysis with large field-of-view in routine cardiac MDCT. The primary purpose of noncardiac analysis is to differentiate chest pain syndrome including aortic disease and pulmonary embolism. In our study, noncardiac analysis could diagnose the cause of chest symptom in 32 of 201 patients in whom coronary artery disease was ruled out. In these patients, additional diagnostic tests could be avoided and might result in reduced medical costs.

Furthermore, as Dr. Rumberger pointed out in his editorial comment (2), noncardiac analysis could be medico-morally necessary. We believe that physicians should review all images and areas irradiated in the cardiac scan. What is most needed at the present time is for the cardiology community to adopt an open mind so as to discuss this issue and to gather further input from various fields.

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